

Report of the Agricultural Research Institute of Ontario

April 1, 1981 to March 31, 1982

LETTERS OF TRANSMITTAL

Toronto, Ontario
March 31, 1982

Mr. R.M. Murray, Chairman
Agricultural Research Institute of Ontario

Dear Sir:

I submit herewith a report of the research programs of the Ontario Ministry of Agriculture and Food in agriculture, veterinary medicine and household science for the year ending March 31, 1982.

Respectfully submitted,

J.C. Rennie
Director of Research
Agricultural Research Institute
of Ontario

Brantford, Ontario
April 1, 1982

The Honourable Dennis R. Timbrell
Minister of Agriculture and Food
Legislative Buildings
Toronto, Ontario M7A 1A3

Dear Sir:

I have the honour to submit the twentieth Research Report of the Agricultural Research Institute of Ontario for the period April 1, 1981 to March 31, 1982.

The Institute wishes to express sincere appreciation for the wholehearted co-operation on the part of the administration and staff of the research institutions of Centralia, Guelph, Kemptville, New Liskeard, Ridgetown, Vineland and Toronto on the planning and execution of research programs in agriculture, veterinary medicine and household science.

Respectfully submitted,

R.M. Murray
Chairman
Agricultural Research Institute
of Ontario

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INTRODUCTION

The Agricultural Research Institute of Ontario was established in 1962 to inquire into programs of research in agriculture, veterinary medicine, and household science, and to recommend areas of research that should receive particular attention.

The Ontario Ministry of Agriculture and Food conducts a wide range of research programs covering livestock, poultry, field crops, horticultural crops, soils, plant and animal diseases, pests, agricultural engineering, agricultural meteorology, land use, water quality, economics, and marketing. These programs are implemented throughout the province: the Ministry's four colleges of agricultural technology are located at Centralia, Kemptville, New Liskeard, and Ridgetown; its three horticultural stations are at Vineland, Bradford, and Simcoe; the Provincial Pesticide Residue Testing Laboratory is at Guelph, and the Economics Branch is at both Guelph and Toronto. The five experimental stations at Arkell, Cambridge, Elora, Guelph and Woodstock are managed by the University of Guelph under contract with the Ministry.

Reviews of these programs are conducted by the Institute to determine whether objectives, staff, and facilities are meeting the needs of Ontario agriculture, and recommendations are made accordingly.

During the year 1981-82, construction was completed on the Fruit Tree Greenhouse and the Research Services Building at the Horticultural Research Institute at Vineland, and on the Beef Research Barn at Kemptville.

BUDGET 1981-82

Centralia College	\$ 98,600
Economics Branch	1,343,700
University of Guelph	15,761,300
Horticultural Research Institute of Ontario	2,520,000
Kemptville College	1,939,100
New Liskeard College	528,300
Pesticide Residue Testing Laboratory	544,300
Ridgetown College	1,409,400
Special Projects	1,003,300
Sub Total	<u>\$25,148,000</u>
Energy Management (funded by Ontario Ministry of Energy)	200,000
Provincial Lottery Research Awards	<u>1,700,000</u>
Total	<u>\$27,048,000</u>

J.C. Rennie
Director of Research

UNIVERSITY OF GUELPH

ANIMAL PRODUCTION

BEEF

Growth Promotants for Beef Cattle

Trials have been completed on the site of implantation for the growth promoting material zeranol (Ralgro) on the performance of steers being fed diets primarily of corn silage. Although steers implanted at the base of the ear gained only marginally faster than those implanted at the mid-ear site, the base site is favored because of ease of implantation.

Crop Residues for Cattle Feed

Simulation studies have been undertaken to design and evaluate various systems of harvesting, storing and processing corn stover for feeding cattle under Ontario conditions. These studies have identified an attractive system to harvest whole plant corn silage and separate it at feeding time into fractions. Related studies include the development of an effective machine to accomplish the separations.

Cull Cows for Beef

Many producers cull cows with insufficient knowledge of their cows' market value. In the first of two trials using lean cull Holstein cows fed high energy diets, young and mature cows made similar rapid gains in the feedlot (>1.3 kg/day) with a similar dry matter feed conversion. Young cows changed in quality grade with a feeding period, whereas mature cows did not. Meat quality work revealed that rib roasts from young or mature cows were equally acceptable to consumers. In the second trial, young cull cows were implanted, but showed no advantage in feedlot performance or carcass characteristics over unimplanted animals.

Non-Protein Nitrogen

Ammonia treatment of corn silage causes a very small ($<10\%$) improvement of digestibility, but one that merits attention by the beef industry. Ammoniated corn silage improved dry matter intake in steers by 3.15%, but increased gain by 7.7%, resulting in a 4.2% improvement in feed efficiency. Ammonia is now available for application on corn silage in Ontario. NPN — now commercially available — applied to corn silage is recommended.

Carcass Evaluation

Work has been conducted on changing the current ribbing site from the eleventh and twelfth ribs to the twelfth and thirteenth ribs for the Canadian beef grading scheme. Because of a slight reduction in fat depth and a slightly larger rib eye, ribbing at the twelfth and thirteenth ribs will allow beef to be more competitive in the export market.

DAIRY

Improvements in Breeding and Selection

Research efforts in breeding and selection of dairy cattle have resulted in several improvements in, and additions to, selection procedures. Sire proofs for milking speed are now published by AI units, providing dairymen with an additional labor and time saving standard. The evaluation of the top cows in each Canadian dairy breed and assessment of their estimated transmitting ability (ETA) have been completed and are being used by AI units to select dams of new bulls. This improvement should increase the efficiency of bull selection as well as the number of bulls being tested by Canadian units. The influence of rump measurement on survivability of calves, and the genetic ability to resist disease challenges are being investigated in two studies. It would appear that improvement of the dairy animal through selection in both instances may be possible. The latter study, in particular, is an industry leader on a world-wide basis.

Protein Requirements of Lactating Cows

Studies on the protein requirements of both first and later lactation cows have shown increased yields of protein, fat, lactose, fat- and solids-corrected milk when dietary protein levels were increased. It may be possible to meet these protein requirements by having more dietary protein bypass the rumen for degradation in the small intestine. The treatment of high quality soybean meal with blood or sodium hydroxide may produce the necessary bypass. The addition of salt at a level of 1.05% of dietary dry matter has also been shown to improve feed efficiency and rate of gain, possibly through improving protein use.

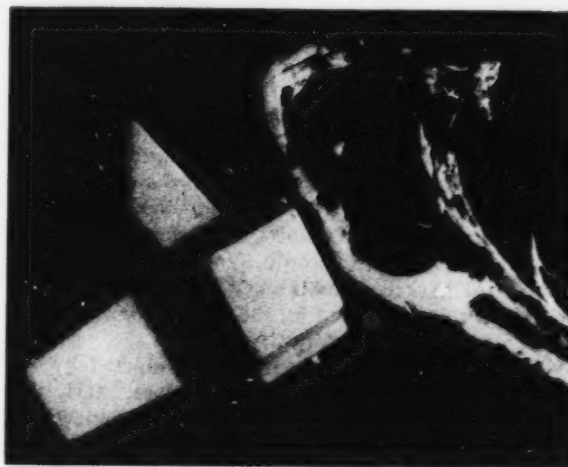


Figure 1. Carcass evaluation: new equipment provides precise measurement of fat and rib eye depths.

Feeding Soybean Protein to Preruminant Calves

The digestive and metabolic problems associated with feeding soybean protein to preruminant calves have also received further attention. Indications are that simple extrusion or fermentation of the soy protein may inactivate the allergens which appear to cause the problems in these calves. Isolated loops of intestine within the calf's body are being used to study these mechanisms.

Increasing Pregnancy

Several studies in reproductive physiology have concentrated on ovarian function in the dairy cow in early lactation. Results indicate that treatments which increase the frequency or magnitude of luteinizing hormone (LH) pulses result in earlier ovulation and successful impregnation in the lactating cow. Work is continuing on methods of producing these changes.

New Findings in Dairy Production

Production systems research involved the use of newspaper as a possible source of bedding for dairy cows, lowering of energy consumption by using low temperature cleaning for milking equipment, and the use of plastic ear-tags containing a synthetic pyrethrum (Bovaid) for fly control among dairy cattle. The newspaper study results indicate that properly shredded newsprint could be used as a bedding material for dairy cows without concern for product contamination resulting from incidental consumption of the material.

The use of low temperature cleaning solvents produced results comparable to those normally obtained with a high temperature cleaning program and at a saving in energy cost.

The use of the Bovaid tag resulted in complete control of horn flies and an approximately 75% reduction in face fly numbers in 37 herds using the tags, when compared with the 23 herds using normal fly control techniques.

Farm Technical Indicators in Dairy Farm Classification

Work continues on the development of a dairy farm classification system using farm technical indicators. These indicators are: (1) size of field equipment; (2) barn equipment for milking, and feed and manure handling; (3) potential productivity of the milking herd and the land. The variables useful in classifying the farms have been identified and the system tested on a range of Ontario dairy farms. Classifying farms into their proper slots, based on technical resources used, provides farm management extension officers with a method of using information and target goals that are specific to that slot in the grid, rather than using general goals and data based on averages. Also, classifying the existing farms into the system provides a basis for predicting potential output when economic variables, which influence farmers' production decisions, change. Finally, the system provides more precise information about farmers' demand for inputs as they upgrade the technical resources used.

Economic Aspects of the Dairy Industry

A comprehensive report on the history, current status and probable future needs for economic research in the

dairy industry was completed. This document is considered to be valuable to the industry and government in the development of policy, particularly as it relates to research needs. Considerable untapped potential for improvement was observed in both production and marketing.

SWINE

Grading Techniques

In an effort to modify the present grading scheme, the concept of electronic grading, combined with carcass weight, has received industry support. During 1981, the Fat Depth Indicator (FDI) was utilized to grade hog carcasses over a wide weight range. Results indicate that readings made on right or left sides of the carcass were not different. Precision was high for the FDI instrument, with residual error variation of 1.2 mm. This appears satisfactory for commercial grading. Precision was similar for all measuring locations except the shoulder site, which had lower values. It is concluded that a single reading by the FDI instrument would suffice for the prediction of carcass lean content, and that utilization of the instrument would lead to greater efficiency in the pork industry.



Figure 2. Piglets enjoy their electronic surrogate sow, an apparatus which will help reduce neonatal mortality.

Ingestive Behavior of Piglets

An electronic surrogate sow has been designed to simulate the major stimuli (warmth, tactile stimulation, and social facilitation of feeding) of the sow-piglet, piglet-piglet relationships. Use of this apparatus by pork farmers could reduce neonatal mortality in large litters and among extremely small or orphaned piglets, and

thus lead to higher standards of animal welfare. The surrogate could also serve as an effective experimental tool to study various stimuli involved in natural nursings.

POULTRY

Ovulation Control in Hens

In order to increase egg production, it is important to understand the mechanisms controlling egg formation. In the past year, adrenocorticotrophic hormone (ATCH), was found to be a potent ovulation-inducing hormone in hens. Another hormone, the follicle stimulating hormone (FSH), may be part of the final physiological signal that initiates other hormone synthesis, which in turn starts the process of ovulation.

Pullet Rearing Systems

With a view towards cutting feed and energy expenditures, experiments were designed to accelerate maturity, so that pullets would have 21-week-mature bodies at 15 weeks. In the first trial, optimal egg production was achieved, but eggs were smaller. In a second trial, a modified lighting program led to more encouraging results. Early maturity represents a potential \$8 million per year saving to Ontario's poultry industry.

Marketing Margins for Broilers

Prices and margins at the farm, wholesale and retail sectors were compared for the period 1965-71 and 1972-80, for both Canada and the United States. (During the second period most broiler production came under supply management in Canada.) Producer prices and feeding margins increased significantly more in Canada than in the U.S., but Canadian producer prices were more stable. Wholesale and retail margins in Canada each rose by over 100% versus 20% and 44% in the U.S. Stocks have increased faster in Canada, and there was less stability in the marketing sector generally. One possible reason for higher Canadian margins is the need for the trade to recover the higher costs associated with increased storage. Canadian consumer prices averaged nearly 26¢/lb more than in the U.S. during 1972-80, versus 3.5¢ more in the earlier period.

DISEASE CONTROL

Health of Feedlot Calves

A study of feedlot mortality, known as the Bruce County Study, was conducted by a multidisciplinary research team over a three year period. The results of the study have been widely publicized, and are as follows. (1) Purchasing cattle from more than one source is a serious risk factor, particularly when the sources are geographically disparate. (2) Limiting the number of calves per group may reduce morbidity and mortality. (3) Changing the roughage from dry hay to corn or hay silage increases health problems if done before the calves have been in the feedlot for at least two weeks. The pathogenesis of this effect is not yet known. (4) Feeding grain, or starter rations, is associated with

fewer health problems, particularly in silage fed cattle. (5) Calves should be kept slightly hungry so that, if healthy, they approach the feed bunk when fed. Free choice roughage should not be available in the first two weeks. (6) Most processing procedures are harmful and should be delayed, and the number or procedures performed at any one time, limited. Vaccination in particular should be delayed until calves are fully settled. (7) The use of antibiotics or sulfa drugs in the water supply should be discouraged. Reasons for the detrimental effects are unknown at this time.

Mastitis

Research designed to determine the role of *Corynebacterium bovis*, a non-pathogenic mammary gland inhabitant, in protecting the glands against infection, has been completed. A field study indicated that about 20% of the quarters of dairy cattle contained *C. bovis* and that cows with only the *C. bovis* microorganism in the milk had significantly lower counts than those quarters infected with mastitis pathogens. The historical presence of *C. bovis* in a quarter had no apparent influence on the subsequent susceptibility or resistance to pathogenic microorganisms which cause mastitis. In highly controlled studies there was about a 10% increase in the somatic cell count following induction of *C. bovis* quarter infections. There were no significant differences observed in milk production or composition of milk from quarters colonized with *C. bovis* compared to control quarters. *C. bovis* infection of the teat ducts appeared to prevent the establishment of most mastitis pathogens within the glands. Intra mammary therapy and teat dipping tends to remove *C. bovis* from the mammary glands. This research indicates that *C. bovis* could indeed serve as a non-medicinal method for mastitis control.

A controlled method for establishing the efficacy of disinfectant teat dips was developed and used to evaluate a teat dip product which contained dodecyl benzene sulfonic acid. Experimental infection rates with *Streptococcus agalactiae* and *Staphylococcus aureus* were reduced 80% and 71% respectively. This product received approval for sale following the assessment of the results.

Respiratory Diseases in Cattle

Respiratory diseases in cattle are major causes of death and reduced productivity. Studies, designed to determine whether the non-pathogenic microorganism *Corynebacterium parvum* altered the bone marrow response and resistance of calves to pasteurella pneumonia (shipping fever pneumonia), were encouraging. This bacterium has been shown to enhance resistance, and the lungs of calves treated with it cleared the pathogens faster. The main clearance cells, the pulmonary macrophages, were increased in numbers, size, and ability to clear bacteria from the lung.

Fatty Liver Syndrome and Altered Drug Metabolism

Fatty liver syndromes in farm animals result from a number of different conditions. Recently, the syndromes have been identified in animals who have died from drug toxicities, usually involving insecticides used on the farm. To date, research designed to

determine the direct effects of an experimentally controlled fatty liver syndrome on drug metabolism has demonstrated changes both in the structure of cell organelles (as determined by electron microscopy), and the ability of the liver to detoxify chemicals. The changes related to liver cell protein formation and fat metabolism in the fatty liver animal prevented the normal detoxification of all insecticides studied. Even relatively mild interferences with normal food intake was shown to have an adverse effect on the metabolic systems involved in drug detoxification. These findings have obvious practical implications for overall considerations of herd health maintenance.

Aleutian Disease in Mink Research

Aleutian disease in mink is caused by a virus that primarily affects the immune system. Past research has shown that infection may cause the non-progressive form on the disease. The abilities of two tests used to identify the non-progressive and progressive forms of the disease, were compared. The older, more widely-used counterimmunoelectrophoresis test (CIE), was found to be more reliable than the newer more sensitive enzyme-linked immunosorbent assay (ELISA). The ELISA test is, therefore, unsuitable in its present form for field diagnosis of aleutian disease.

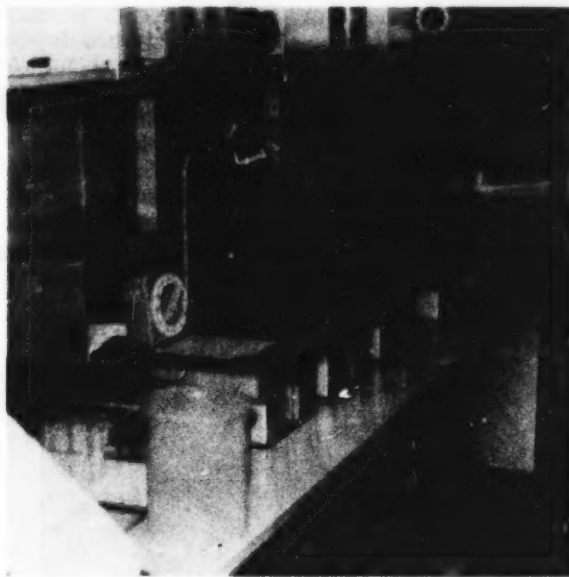


Figure 3. *Immunoelectrophoresis equipment is used to identify aleutian disease.*

Fish Nutrition

Studies designed to determine optimal levels of vitamins and minerals for raising trout on fish farms were conducted. Juvenile trout tolerated all levels of Vitamin D₃, indicating that trout are resistant to excess Vitamin D₃. Vitamin E, an essential micronutrient for aquatic animals, is available as D alpha tocopheryl acetate. Studies of the absorption, distribution and metabolism of these two forms of Vitamin E, using radioisotope labelled sources, indicated that the two were comparable once absorbed into the plasma, but that D alpha tocopheryl was more readily absorbed.

Gill Disease in Fish Farming

A retrospective four year study of submissions to the

Fish Pathology Laboratory at the Ontario Veterinary College has demonstrated that bronchial pathology of gill diseases was the main cause of death and disease in over 20% of the submissions. A number of different bacteria were isolated but in most cases there was also evidence that poor water quality, especially high ammonia and suspended solid levels, contributed to the disease processes.

Research designed to determine the relative importance of the different environmental factors alone and in combination on the respiratory system of trout, is in progress. Early results indicate that ammonia exposure alone will interfere with feed intake and voluntary activity, and will cause cellular changes in the trout respiratory tissues.

Detection of the Carrier State of Porcine Stress Syndrome

Porcine Stress Syndrome (PSS), causes a very undesirable watery appearance to the pork from affected animals. The purpose of this study, which was conducted in cooperation with the Ontario Pork Producers, was to evaluate and develop reliable methods for identifying carriers of PSS. Results indicate that an extended test, which combined halothane and succinylcholine exposure, identified a much higher percentage of carriers than the standardized halothane challenge system.

Several other blood chemistry and blood cell tests were conducted in order to determine if one or more of these tests would aid in identifying the carrier state of PSS. None of the tests for muscle enzymes or red blood cell fragility correlated with the extended or straight halothane tests. Changes in other cellular components of blood and muscle tests, as determined by muscle biopsy, that showed evidence of high correlation with the live animal tests are still under investigation.

FIELD CROPS

GRAIN CROPS

Research Enhances Production Prospects for Triticale

Lines of triticale, the man-made crop species developed from rye x wheat crosses, often have shrivelled seed and low fertility. Earlier studies had indicated that plump kernels and restored fertility occurred when wheat chromosomes replaced some of the rye chromosomes. Now, cytogenetic analysis of lines from the Guelph winter triticale program indicates that kernel plumpness and fertility can be found in triticale with the full complement of rye and wheat chromosomes. This finding greatly simplifies the task of the triticale breeder.

Nursery for Winter Hardiness of Winter Wheat

Previous tests of various wheat varieties for winter hardiness have been consolidated with the establishment of a Canadian Winter Hardiness Nursery. This nursery, which was initiated by Guelph researchers, is being grown at locations in Alberta, Saskatchewan, and Ontario. It is expected that new locations in Manitoba and the Maritimes will be added in subsequent years. A co-ordinated nursery of this type, designed to identify elite material for winter hardiness, is the first of its kind in Canada. It will serve both as a mechanism for greater

exchange of germplasm among workers interested in winter wheat, and as a means of sorting out the hardier lines coming from the Guelph and other breeding programs. Guelph researchers will summarize data, distribute seed, and provide general co-ordination.

Corn Hybrids for Silage corn

While Ontario farmers are supplied with comparative information on the performance of corn hybrids for grain production, no similar information has been provided for whole-plant silage production. Studies have been conducted to determine whether the hybrids performing best in the grain trials are necessarily best for silage production. The findings suggest a need for separate evaluation trials and that, on a relative basis, there is as much, if not more, variation between hybrids for whole-plant dry matter yield at silage harvest time, as there is between hybrids for grain yield at grain harvest time.

Corn Hybrids for Northern Ontario

Research was initiated in 1981 in cooperation with New Liskeard College of Agricultural Technology and the Extension Branch of OMAF, on the adaptability of early-maturing corn hybrids to Northern Ontario. Fifteen hybrids of European and Canadian origin were grown in tests in five districts. Yields of whole-plant dry matter in excess of 10 t/ha were achieved in all tests, and the earliest hybrids reached 70% moisture by mid-September at all locations. The earliest hybrid, Edo, a German hybrid grown in Northern Europe, reached 40% grain moisture by mid-to-late October; at this stage of maturity it would be suitable for the production of high-moisture ear-corn silage. The work will be repeated in 1982, and will lead to hybrid recommendations for corn production in Northern Ontario.

FORAGE CROPS

Winter Survival of Forage Legumes

Plants of alfalfa and birdsfoot trefoil, fertilized with different levels of potash, were dug from the field in the late fall and in the early spring. The plants were then subjected to temperatures below freezing, or to flooding, or were frozen in ice to determine their tolerance to such stresses. In this test, survival after these treatments was not affected by previous fertilization with potash. In the fall, alfalfa survived low temperatures better than birdsfoot trefoil, while the reverse was true in the spring. Survival was reduced at temperatures below -7°C , and also as the length of time exposed to low temperatures was increased. There were no differences between alfalfa and trefoil in recovery after the flooding or icing treatments.

The time of fall cutting of birdsfoot trefoil was found to affect survival and forage yield in the succeeding year. The critical date was September 7; cutting on that date resulted in the least survival, and the lowest yield in the succeeding year. The critical fall harvest date for birdsfoot trefoil is about 10 days earlier than the critical date for alfalfa.

Tissue Culture Contributes to Breeding of Forage Crops

The development of whole plants in a test tube from a small amount of tissue placed on a special nutrient medium, has been adapted for use in the forage breeding program. This technique is being used to: (1) propagate and store genotypes; and (2) select genotypes. Over 600 different genotypes of birdsfoot trefoil are now being stored in small sterile containers held at 4°C , thereby reducing production costs and precluding chances of pest and disease infestations. These are being

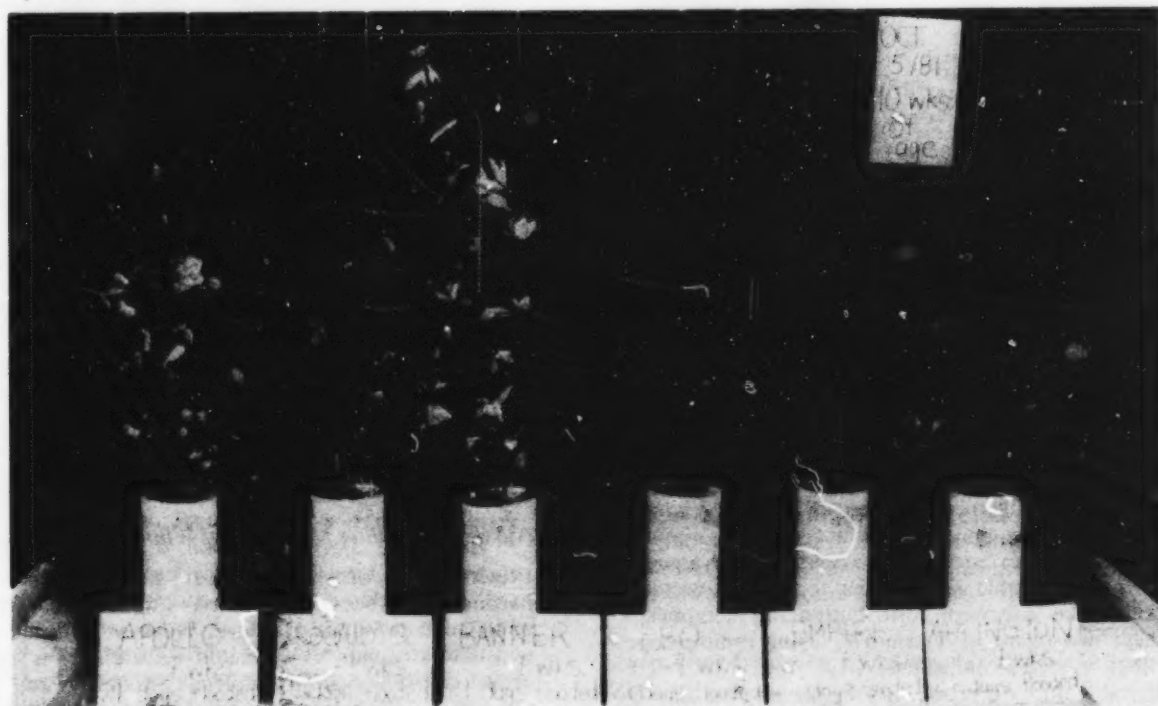


Figure 4. Shown above is a comparison of flooding tolerance of forage legumes. Apollo, Iroquois and Banner alfalfa had significant leaf yellowing after 21 days of root flooding.

Arlington red clover had slight yellowing, whereas Leo and Empire birdsfoot trefoil had no leaf yellowing.

held while their progenies are tested in the field, and the superior types will be utilized at a future date to develop cultivars.

In red clover, the field performance of plants derived from tissue culture was compared with that of plants derived from cuttings. Both groups had similar forage and seed yields in the year of planting. However, in the second year after planting, plants derived from tissue culture had better winter survival, were more vigorous, and produced higher forage yields.

Plants of birdsfoot trefoil derived from tissue culture were grown on a medium containing the herbicide 2,4-D. Those plants identified as tolerant to the herbicide were then used to study the inheritance of such tolerance. Results indicate that tolerance to 2,4-D is inherited, and further selection is under way to develop a tolerant cultivar. Such a cultivar could be sprayed with 2,4-D to eliminate weeds, with no adverse effect on that cultivar.

Storing Round Bales of Hay

In a cooperative program between the School of Engineering and McKee-White, Inc. of Elmira, large round bales of hay were made and some were wrapped in clear plastic, using an attachment which wrapped the bales at the time of their formation. Wrapped and unwrapped bales stored in various orientations from July 1980 were evaluated in March 1981. Visual observation of the stored bales, before and after they were cut open, showed the following: (1) bales stored inside appeared loose but the hay was of almost original quality; (2) vertically stored bales showed the greatest amount of deterioration due to water penetration through the bale, leaving them unfit as feed; (3) bales stored horizontally on pallets showed negligible deterioration. Wrapped bales stored on the ground showed less deterioration (3-6 cm) than unwrapped bales (10-25 cm) because of reduced water absorption and ground contact.

PROTEIN AND OILSEED CROPS

Breeding Improves Potential of Canola Production

Research has led to the development of Canola lines that are resistant to triazine herbicides. The cytoplasmically inherited resistance, discovered in a weed called bird's rape in a corn field in Quebec, has been successfully transferred to Canola (both Polish and Argentine types). These new Canola lines are very resistant to most triazine herbicides, which could greatly improve weed control efforts in Canola and should also eliminate the risk of atrazine injury to Canola crops following corn in a crop rotation. This research at Guelph provides one of the first examples of transferring herbicide resistance from a weed to a major crop species. The development should help establish spring Canola as an alternative cash crop in the short season areas of Ontario.

HORTICULTURAL CROPS

VEGETABLES

Heavy Metals Increase Ozone Damage to Vegetables

The presence of active heavy metals in the soil, such as nickel, cadmium and copper, greatly increases the sensitivity of vegetable crops to oxidant smog pollution. The main plant-injuring component of the pollution, ozone, is produced by reactions of nitrogen oxides and hydrocarbons in sunlight. Sensitive vegetable crops include peas, beans, corn, lettuce and cress. Research has indicated that combined heavy metal-ozone treatments are more injurious than ozone alone. Also, ozone exposure stimulated heavy metal uptake by the plants. This research suggests that areas with heavy metal contamination of soils will have much greater ozone injury to vegetable crops, and that ozone exposure will increase the accumulation of heavy metals from contaminated soils.

ORNAMENTALS

Light Stress Induced Micronutrient Deficiencies in Roses

In an initial study on the effects of high intensity distribution (HID) lighting on the status of foliar micronutrients in roses, copper was identified as a micronutrient most rapidly depleted in leaves of roses produced with supplementary high pressure sodium irradiation. Recommended fertilizer levels for soil-less culture (.02-.05 ppm) were not sufficient to maintain the foliar copper content above the critical 5 ppm concentration.

Mass Micropropagation of African Violets

African violets were mass propagated *in vitro* from chopped leaves and chopped half plants with as many as 400 plantlets being produced from the latter. This is a seven-fold increase over a propagation technique in which the explant was a quarter leaf segment placed upright in a test tube with one quarter of its length embedded in the medium.

FRUITS

Interspecific Strawberry Hybrids

A wide diversity of genetic material has been collected at Guelph and Cambridge and used for breeding. One use has been in interspecific hybridization, which is the crossing of existing cultivars of a particular species with other species which occur in the wild. A unique strawberry hybrid has been produced which contains genetic material from five wild species as well as from the cultivated strawberry. It is the first strawberry with such a diverse background that has commercial potential.

Strawberry Harvester Developed

A prototype strawberry harvester developed in the School of Engineering was shown to be effective in removing sufficient berries from a patch at the

conclusion of hand-picking to make its use practical. Many of the recovered ripe but damaged berries were suitable for processing. Use of the harvester on previously unpicked rows of strawberries resulted in the same percentage of good berries as was gained by hand-picking adjacent rows.

SOIL AND WATER MANAGEMENT

Data Microloggers Facilitate Use of Weather Information

A recent advance in semi-conductor technology is a simple device that monitors air temperature and wetness duration on fruit and vegetable crops that require application of chemicals for control of diseases and insects. A prototype of this device has been tested in a number of crop situations and found to be just as reliable as the more expensive standard instruments that require daily manual observations. It is being manufactured, and will be on the market in the spring of 1982.

Data microloggers have also made it possible to record most weather variables on magnetic tape for immediate, or later computer processing on printed summaries, thus bypassing the time-consuming manual abstracting. This automation has begun at the Elora Research Station weather recording site.

Control Measures for Nutrient Loss and Soil Loss

An integrated approach to the problems of soil erosion in Ontario has been developed. Watershed investigation has demonstrated that virtually all the sediment-generating events result from rainfall or a combination of rainfall and snowmelt conditions. Under spring conditions, especially with frozen subsoil, the saturated to supersaturated soil-water conditions give a low soil density and low shear strength which promote a high soil erodability. These watershed results have been supported by laboratory tests of changes in surface soil properties with soil-water changes. A rainfall simulator and soil-erosion water flume have been designed, constructed and calibrated.

To determine what areas have unacceptable soil erosion and what the impact of soil erosion is on-site and on receiving waters downstream, a computer model has been developed. It estimates soil loss and transported sediments from field-size areas, and integrates the sediment loads generated by, and delivered to, the outlet of small agricultural watersheds. It has also been designed to estimate spring and summer erosion and sediment quantities separately. The model has undergone calibration on five small agricultural watersheds in southern Ontario. The results are being used for the planning of remedial strategies.

In related analyses of remedial measures for erosion control, it has been established that chisel-plowed land with residue exposed has substantially less soil loss in the early growing season than moldboard plowed land, especially if the latter is left with a rough surface with no secondary tillage. This and other remedial strategies have been evaluated by the computer model GAMES (Guelph evaluating model for Agricultural Management systems on Erosion and Sedimentation) which was

developed in 1981. For quick analyses, nomographs for prediction of field soil erosion losses and for streambank soil erosion losses have been produced.

Capabilities of Water to Assimilate Agricultural Runoff

Limnocorrals have been used to assess the environmental impact of pesticides in Ontario lakes. This method of enclosing an open-ended "tube" of water in a lake allows the assessment of the impact of pesticides on a large natural population of many different organisms.

Investigations so far have dealt with the changes in concentration of atrazine and of methoxychlor, and their metabolites, over time in lake water. Effects on oxygen levels, chlorophyll concentrations, phytoplankton and zooplankton were examined. Results of the work suggest that little environmental damage is likely to result from atrazine residues in Ontario watersheds. Similarly, concentrations of methoxychlor less than 3 g/L (a dilution of 100-fold below the recommended field rate for black-fly control) should cause minimal environmental impact in lake ecosystems.

WASTE MANAGEMENT

Methane Gas Demonstration and Research

A major new facility is now in place at the Arkell Research Station. It has both a farm scale digester and two research digesters. This will make it possible to conduct research on various uses of methane gas and to demonstrate its practical use on the farm.



Figure 5. Methane gas represents a potential source for on-farm heat and electrical energy, a source which is natural, renewable, and relatively pollution-free.

Beef Manure Handling

Researchers from several departments developed a linear programming model of beef manure handling systems. The model will be a tool for advice on systems of manure handling to extension workers and farmers.

Nutrient Recovery from Processing Wastes

Research involving recovery of solids from wastes of food processing has yielded valuable nutrients and reduced severe problems of pollution. In a recent trial, the filtration process separated the original waste material into a solid portion amounting to approximately 40% and a liquid portion amounting to approximately 60% of the original waste input volume: concentration of solids in the separated stream was improved from a material value of 11.6% to 17.9% after modification of the separator. Based on these results, the feedlot company would transport 179 kg solids/t versus 116 kg/t in the untreated waste. Transportation efficiency would thus be improved by approximately 54% through separation.

LAND USE

Land Base Limits Agricultural Production

If beef imports or feed grain imports were curtailed, a modified version of the Land Evaluation Model (LEM-2) has predicted the following consequences: (1) imperfectly to poorly drained lands would have to be brought under cultivation for forage production; (2) lands with a low moisture holding capacity in southern Ontario would be necessary for fruit, vegetable and tobacco production; (3) all other land areas would become necessary for grain production.

Nitrogen from Legumes in Crop Sequences

Red clover as a supplier of nitrogen (N) to the subsequent crop was studied as a hay crop and as a plowdown crop. It was determined that a barley crop obtained the N equivalent to 48 kg N/ha from a previous red clover hay crop. Plowdown of red clover in the establishment year resulted in the equivalent of 38 kg N/ha to a succeeding barley yield. In another experiment, alfalfa in the establishment year supplied substantial N to a succeeding corn crop. A one-year alfalfa crop provided adequate N for a succeeding crop. It was also found that increasing the level of N applied to either previous brome-grass or corn crops reduced the response of a succeeding corn crop to N fertilizer. These findings confirm that legumes contribute significantly to succeeding crops. More importantly, data were obtained that will improve recommendations for N application required for crops following legumes. This will result in significant benefit to Ontario agriculture as the cost of fertilizer N continues to escalate.

Availability of Manure Nitrogen

Research data obtained recently suggest that two manure nitrogen (N) components should be considered in relation to crop response. Manures differ significantly with respect to relative concentrations of

organic N and ammonium N. The latter form is immediately available for crop uptake whereas the former becomes only gradually and partially available over the growing season. It has been found, for example, that liquid dairy manure N is much more available than solid beef manure N. Taking this into account will result in much more efficient use of manure N, and will require revised recommendations for application of manure N.

Soil Structure, Tillage, and Crop Growth

Corn grain yields tended to be more closely correlated with fineness of soil in the seed bed, than with soil density or soil strength. Regardless of soil type, there appears to be no advantage in preparing the seed bed deeper than 6 to 8 cm. The first three years of research on a silt loam with strip tillage practices indicated there is no corn grain yield response to preparing seed bed strips wider than 13 cm for each row of corn. Research on strip tillage will be continued on an expanded scale and will include more soil types.

PEST MANAGEMENT AND DISEASE CONTROL

Breeding to Control Verticillium Wilt of Alfalfa

Several additional areas in Ontario have been added to those reported to have Verticillium wilt in alfalfa. Because of the serious potential of this disease, a great number of alfalfa crosses at various stages of genetic



Figure 6. Biological control laboratory provides modern facilities for studying non-chemical control of insect and weed pests.

stabilization have been evaluated for resistance, with promising results. In testing the susceptibility of other crops to the alfalfa strain of *Verticillium* it has been found that both soybeans and peanuts are prone to attack by *Verticillium*. Thus, a disease new to alfalfa may prove to be even more serious for growers in soybean and peanut cashcrop production.

Relationship of Sap Beetles to Mycotoxins in Corn

Sap beetles which overwinter on corn cobs that are partially buried in the soil are capable of transferring *Fusarium* spores from the old cobs to new cobs in the developing crop. Since *Fusarium* is the principal cause of mycotoxins in corn, the role of this beetle previously regarded as harmless now assumes new significance.

Fermentation Controls Tomato Canker

It has been demonstrated that fermentation of the tomato seed, using the natural ferment that arises from the surface-borne organisms on the fruit, will eliminate from the seed the internal pathogen which causes the bacterial canker. It has been shown that during fermentation certain microorganisms exhibit a high potential for producing antibiotics and organic acids to which the canker pathogen is highly sensitive. Thus, fermentation of harvested seed offers a cheap and effective biological control of the canker disease.



Figure 7. *Onion maggot flies are being reared for sterile male release program in Keswick.*

HONEYBEES

Remote Sensing Activity in Honeybee Colonies

Instrumental methods were developed for monitoring honeybee colonies by remote sensing. Sound production, as an index of activity, temperature and carbon monoxide concentration, was measured. Remote sensing methods provide valuable information on conditions in the hive with a minimal disturbance to the bees.

FOODS AND FOOD QUALITY

Loss of Vitamin A in Stored Milk

Federal regulations require the fortification of skimmed and partially skimmed milk with Vitamins A and D. Studies of milk packaged in plastic pouches and of milk receiving the ultra high temperature process (UHT) have revealed that added Vitamin A may not be as stable as the Vitamin A naturally present in milk. These studies suggest problems may occur with the fortification program, leading to products that are illegal through low Vitamin A content and to reduced nutritional quality for the consumer. Further studies are being conducted with the objective of improved stability of added Vitamin A.

AGRICULTURAL ECONOMICS

Supply Management and Stabilization Programs

A study of these programs began by building a simulation model of the North American beef and pork sector. This model was then used to study probable effects of various policies over long term periods. Analysis indicates that either deficiency payment or supply management programs can generate approximately the same level of increased investment and revenue to the cow-calf sector.

Price Forecasting and Hedging

Live cattle and hog futures are not widely used as a hedging mechanism. Futures prices do not always accurately forecast prices. They do, however, provide opportunities for risk reduction through selective hedging. Analysis of hog prices indicates a decline in seasonality of production in North America and a decline in sensitivity to feed price changes. Data collection and modelling to assist in forecasting prices and policy analysis have advanced significantly on wheat, eggs, oilseeds, and livestock.

Factors Influencing Adjustment by Limited Resource Farmers

The study found that farmers considered expansion when the operators: (1) possessed the management and technical skills for improvement; (2) were willing to accept risks; and (3) had high desire for achievement and extra profits. With respect to credit risk by low income farmers, the study found that if variable and/or deferred repayment schemes were available from the credit system, these operators would be more willing to undertake expansion programs.

RURAL LIVING

Retirement Incomes

Studies of people recently retired determined that higher proportions of rural retirees reported adequate levels of retirement income than did urban residents. It was also found that men were more apt to find their retirement incomes adequate than women. A larger portion of rural than of urban retirees continued to work, at least on a part-time basis.

Effectiveness of OMAF Extension and Communication Efforts

The coverage and effectiveness of some OMAF sponsored programs and activities were investigated. Nearly 50% of the province's farmers reported they have made use of the OMAF extension programs offered at the county level. Of the farmers who have been involved in county OMAF programs, 93% were either satisfied or very satisfied with them. OMAF publications and bulletins which were received by 88% of Ontario farmers were highly regarded. Three quarters of the farmers have used the soil analysis service, and over one third have used the feed analysis service.

Feed Advisory Service

A study of the Dairy Feed Formulation Service yielded substantial evidence of users' perceptions and satisfactions with the service. The results provided a major input into the review of the Feed Advisory Service, and found expression in the revised proposals drafted for this Service.

CENTRALIA COLLEGE OF AGRICULTURAL TECHNOLOGY

FIELD CROPS

Field Beans Progress

Evaluation of herbicides for efficacy and crop tolerance in white beans and kidney beans continued in 1981. Forty-six treatments and 17 products were tested. The latter included hoe-grass, which was registered for use in field beans.

Twenty-five varieties of field beans were tested on campus (2800 CHU), and at a site near Brussels (2650 CHU). Other experimentation included light red, dark red, cranberry, pinto, pink, and black varieties of beans, because of a general increase in colored bean acreage in western Ontario in 1981.

In the sixth year of a crop rotation test, all plots were in white beans. To date, the alfalfa rotation has produced the highest yields, while continuous beans plots have produced the least.

Stand reduction trials in white beans were also conducted, as well as cultivar testing of sunflower, flax and canola.

Pest Control for Rutabagas

Seven herbicide products were tested in a total of 15 treatments for efficacy, phytotoxicity, and crop residue. Although no new herbicides were registered for use, residue samples appeared both safe and efficient for weed control. The residue samples have been submitted for Dual.

Seven products were screened for flea beetle control and four for root maggot. Preliminary trials indicate root maggot can be controlled by soil fumigation. Both the per hectare yield and the percentage to marketable rutabagas were increased in this way.

Soybean Studies

Thirty-six entries were screened in the soybean variety test. Other trials on soybeans included screening

fungicides for white mold, a planting date study, a stand reduction study, and the comparison of two growth regulators to increase yield.

Barley Safeguards

A test of Bayleton fungicide on barley produced a yield increase from 4.07 t/ha in the non-treated area to 4.64 t/ha in the treated barley.

An extensive study on the ecology of proso millet was completed this year. Barley proved to be competitive with proso millet. Seed production of the millet was significantly reduced in barley as compared to corn and white beans.

Plowed Down Forages Increase Yields

Seven forage species were evaluated as plowdown species. Double-cut red clover provided the greatest amount of topgrowth. Corn grown on forage plots that had been seeded and plowed the previous year had the highest yield in the double-cut red clover plots.

AGRICULTURAL BUSINESS MANAGEMENT

Young Farmers Profiled

In 1981-82, the results of a study on factors affecting the establishment and success of young farmers were published. Not surprisingly, the amount of financial support provided by parents was found to be the most important factor. Data collected from a sampling of rural youth is being used to assess the management skills acquired by young farmers.

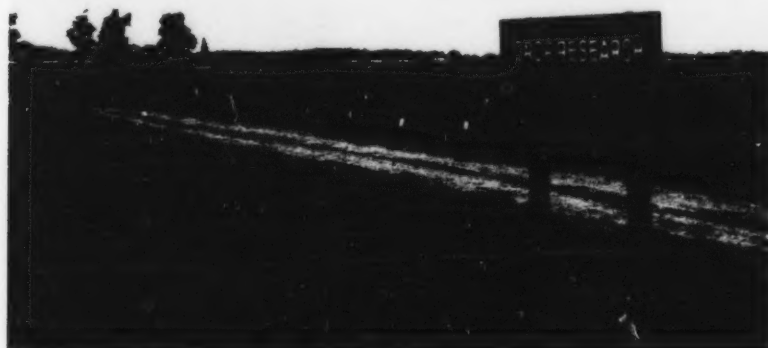


Figure 8.

ECONOMICS BRANCH

ANIMAL PRODUCTION

Beef Feedlot Cost Study, 1980

Advancing interest charges and feed prices, as well as negative price margins, resulted in lower returns in 1980 than in 1979. Returns after allocated expenses per feedlot enterprise declined from \$8,821 in 1979 to a loss of \$17,686 in 1980 for 26 farms. Returns after allocated expenses per hundredweight (cwt) of beef produced were a loss of \$9.03 in 1980 compared to a gain of \$4.16 in 1979. Total allocated expenses/cwt of beef produced were 14% higher in 1980 than in 1979. Total feed expense/cwt of beef produced was nearly 11% higher in 1980 than in 1979. Feed accounted for nearly 68% of total allocated expenses in 1979 and for nearly 66% in 1980, while interest charges amounted to almost 14% in 1979 and close to 16% in 1980. Returns after total allocated expenses declined from \$37,188/farm in 1979 to \$12,455 in 1980 for the feedlot farm.

FIELD CROPS

Custom Farmwork Rates, 1981

Increased mechanization in Ontario farms has caused many farmers to overinvest in specialized machines. Custom farmwork services provide farmers with access to this specialized equipment without prohibitive or crippling investment. The 1981 survey for six areas of Ontario showed an increase in custom farmwork rates throughout the province. This was due to higher fuel and repair costs. Within each area, variations in custom rates occurred because of differences in field conditions, size, kinds of crops residues handled, competition from other custom operators, and timeliness required.

The Economics of Soybean Production, 1980

In 1980 the southern agricultural district of Ontario grew 94% of the province's soybean crop. The remaining production was divided among the western (3%), central (2%), and eastern (1%) areas. Improved weed control sprays and the development of new higher yielding short season varieties, have encouraged the expansion of soybean production into new growing areas.

The 74 growers studied in 1980 harvested an average of 2.5 t/ha. Total average production costs for the growers were \$755/ha and \$302.32/t. Operating or cash costs of \$216/ha and \$86.48/t accounted for 29% of total costs.

Land use was the largest single cost in soybean production, at \$402/ha or 53% of total costs. The major operating or cash costs were for materials such as seed, fertilizer, sprays and inoculants which amounted to \$134/ha or 18% of all costs. Input costs as a percentage of total cost could be broken down as follows: labor, 4%; tractor, machines and custom

charges, 16%; materials, 18%; land use, 53%; allowance to management, 5%; minor inputs (crop insurance, interest on operating capital, marketing board fee, and miscellaneous), 4%.

The 1980 survey indicated that soybeans can compete with corn and other grains as a profitable cash crop for growers across the province. Soybeans appeared to have an advantage over corn when the price of production inputs was rising, because they incurred substantially lower operating costs.

On-Farm Drying and Storage Costs for Corn, 1978 and 1979

Information was collected on the annual operating and fixed costs for three corn drying systems; in-bin, batch, and continuous flow. The report complements an earlier study, "On-Farm Drying and Storage Costs for Corn, Ontario, 1978". The two studies allow for comparison of corn drying costs for the same 37 growers in both 1978 and 1979.

Steadily increasing energy costs and varying levels of moisture content from year to year make fuel a major cost item in the artificial drying of corn. The average operating costs (fuel, electricity and labor) for all drying systems were \$5.48/t and \$4.48 in 1979 and 1978 respectively. The fixed costs of drying were slightly lower in 1979 at \$3.16/t compared to \$3.66/t in 1978. The cost variation was a result of increased annual use of the drying facilities in 1979 over 1978.

The average on-farm storage costs for all storage systems amounted to \$2.25/t in 1978 and \$2.12 in 1979. Variations in storage costs among growers depended on the age of the storage structures, the type of each structure, and their annual use.

HORTICULTURAL CROPS

The Cost of Establishing a Vineyard

The total cost of planting and bringing a new vineyard into production over the 4½ year establishment period was estimated at over \$5,147/acre. By amortizing this total cost over a 20-year period at an interest rate of 14%, the annual cost to be charged to the producing vineyard would be \$777/acre. This cost applies only to this type of vineyard, planted in 1977 and coming into production in 1981. If different cultural practices were used, or if the years of establishment were different, costs would vary.

Estimated Cost of Growing Potatoes, 1980

Potato production costs in 1980 were estimated at about \$875/acre or about \$4.20/cwt. A cost breakdown would be as follows: machinery, \$215; labor, \$65; materials, \$290; land, \$90; storage, \$60; and management

allowance, \$75. Cost estimates for 1980 were 40% higher than the 1978 estimate. Input costs in 1980 increased significantly in comparison with 1978: machinery, 60% higher; labor, 20% higher; materials, 30% higher; land, 55% higher; and management costs, 60% higher.

FARM MANAGEMENT

A Method for Determining Land Costs

The speculative component of current farm land prices should not be considered as a cost to the agricultural enterprise. This component can be removed by subtracting a land price inflation rate from the FCC interest rate normally used for calculating enterprise land costs. In 1979, anticipated inflation in land prices accounted for over 60% of total land costs.

AGRICULTURAL MARKETING

International Trade in Agriculture and Food

Summary statistics for six geographic areas and six sections were compiled from a 1971-80 data base containing the total indices for imports and exports. During this period the import index rose in all years, except in 1977, to a value of 183 (1971=100). The export index remained relatively constant until 1978, and stood at 169 in 1980. In terms of constant values, the net trade deficit peaked in 1976, and has decreased since that year. Trade data is added annually to the data base.

Impact of Metric Packaging on Fluid Milk Consumption

The study used Thunder Bay as a test market to determine whether the change to metric packaging had any impact on aggregate consumption of fluid milk and/or on the purchase of particular-sized packages of fluid milk. Metric packaging did not influence aggregate consumption. However, when the 2 qt package was converted to 2 L and the quart package became the 1 L package, purchases of the former increased and purchases of the latter decreased. The switch was not price related.

HORTICULTURAL RESEARCH INSTITUTE OF ONTARIO

PRODUCTION AND BREEDING RESEARCH — VINELAND STATION

Energy Conservation with Protected Crops

Two energy efficient greenhouses, designed to complement and expand energy conservation studies, were constructed. Research to date includes efficiency studies of heating techniques, the effective positioning of heat sources, the evaluation of glazing and insulating materials, and the roles of nutrient film techniques and thermal blankets in energy conservation. Test plants include tomatoes, cucumbers, roses, and other floricultural crops.



Figure 9. Veeblue plums show great promise.

Efficient Production Systems

Experiments are currently underway in the recently refurbished mushroom research unit to determine an effective means of controlling sciarid fly. This pest is a considerable burden to Ontario's \$35 million mushroom industry.

Preliminary results from a test studying supplementary lighting in greenhouses indicated that the practice is not economical for cucumbers and tomatoes.

A study was initiated to determine the economic feasibility of growing peaches in a protected environment. Anticipated advantages include: early ripening fruit, increased yields, freedom from canker disease, and the possibility of growing peaches in colder climates.

In-orchard management studies were expanded. These studies use different trellising and density systems to improve productivity and net returns.

High density and rootstock studies with grapes, cherries, and plums continued with the objective of

increasing productivity and net returns. Nutritional studies revealed that calcium and magnesium sprays alleviate stem necrosis disorder in grape bunches. Results from calcium chelate treatments designed to reduce bitter pit in apples were inconclusive.

Improved Cultivars

Veeblue plum highlighted the fruit cultivar development sector. This plum, which matures about the end of the first week in September, is earlier than most European plums, and is of a better quality than others in its season.

Two new grape selections were tentatively approved for naming: V.6631, a white selection that produces a high quality wine, and V.65164, a promising new red seedless dessert selection, which matures with Fredonia.

Significant progress has been made in developing crack resistant self-fertile sweet cherries, high quality early maturing canning clingstone peaches, and good quality early maturing European plums. A number of selections are nearing the point of release. The strawberry selection 6747R6, which is the most



Figure 10. The use of thermal curtains and supplemental lighting is becoming commonplace in the greenhouse industry.

promising processing type selection for freezing in 4 + 1 or IQF packs, will play a prominent role in the development of mechanical harvesting and processing technology. Two hardy rhododendron selections, V.72231 (yellow) and V.72121 (apricot) show excellent promise following the test winter of 1980-81.

HORTICULTURAL PRODUCTS LABORATORY — VINELAND

Peach Maturity Index

A maturity index has been developed which gives close approximation of desirable harvest dates for peaches, although some refinement is still needed. The effects of various containers, quick cooling methods, and post-harvest treatments, and their relations to shelf life and market acceptance, are under study.

Fruit and Vegetable Evaluations

A total of 227 cultivars were tested at the processing laboratory in 1981. Of these: (1) 84 were strawberries tested as a frozen product; (2) 47 were freestone peaches, tested both as frozen and canned product; 22 were clingstone canned peaches; and (3) 124 were tomatoes tested as both whole pack and strained product. Three HRIO strawberry selections (6747R6, 7251R2, and 7251-5) were particularly outstanding for firmness, appearance, and flavor. Two HRIO selections of clingstone peaches (V.68272 and V.68274) received consistently higher scores than Veecling. Four HRIO tomato selections (Ontario 829, 787, 818, and 7924) rated in the top 10 out of 124 tested for both whole pack and strained product.

Cranberry Cultivars

Work to select and develop suitable varieties of cranberries for use by the Iroquois Gibson Band at Bala is continuing. This project, which is conducted in cooperation with the Band and receives support from the New Crop Development Fund of Agriculture Canada, has identified suitable varieties and cultural techniques. Longer-scale growing tests will be initiated in 1982.

Wine and Grape Evaluations

Wine and grape evaluation research continues to be a major activity of the laboratory. Thirty experimental wines were made from 24 of the most culturally successful grape selections produced in the breeding program. V.63331 proved successful both in the vineyard and for wine quality; Veeblanc and V.50201 rated high for wine, but somewhat lower in the vineyard.

Standards for Grape Selection

The laboratory is endeavoring to develop a computer analysis of the entire crop sold to wineries in Ontario. The objective is to provide standards for the implementation of a quality basis for pricing and purchasing wine grapes. For most cultivars this analysis now includes the crops for the years 1979, 1980 and 1981. The wine industry plans to use this information to initiate a pricing system based on quality for six of the important grape cultivars.

Evaluation of grape cultivars and selections based on flavor characteristics such as methylantranilate has been completed. These analyses permit early selection of seedlings for non-labrusca flavor types and greatly enhance the breeding program. Evaluation of wine grape cultivars for production of fresh grape juice

indicates that several of these make excellent juice products and could serve in this capacity to replace European grape juice imports.

Celery Storage

Storage studies with fresh celery produced at the Holland Marsh show that celery can be kept up to 70 days in good condition when exposed to certain treatments. Results of up to 90% recovery were obtained by storing celery that had been hydrocooled, using water containing chlorine, Botran, and Benlate prior to placing in a filacell cooled storage room.

HORTICULTURAL EXPERIMENT STATION — SIMCOE

Apple Trees

Induction of lateral branching on spur-type apple trees can now be accomplished routinely with the use of 6-benzyladenine or Promalin. Number and length of laterals can be altered by adjusting concentration. Such treatments are much more successful when applied to trees after at least one year in the orchard.

Chemical prevention of flowering may prove difficult in young trees not carrying a crop. Further work is underway to evaluate the role of cropping in chemical flower-formation inhibition in apples. A pilot study of trickle irrigation effects on bearing McIntosh apple trees showed a small fruit size increase under moderate crop-load conditions. No adverse effects on fruit maturation, physiological characteristics, or storage behavior was observed.

Apple Storage

Research in 1981 concentrated on the study of apple maturity in relation to ultra low oxygen storage for maximum fruit quality. Ethylene concentration in the gas sample extracted from the air space inside the fruit core was the best maturity index. A rapid rise in ethylene production indicated the transition from maturity to the onset of the ripening phase. The time for this transition varied among cultivars.

McIntosh apples showed an earlier and more rapid transition phase than other cultivars. Rate of onset of ripening depended on ambient temperature. Consequently, earlier ripening cultivars such as McIntosh showed a more rapid ripening than late cultivars such as Delicious or Northern Spy. Suitable maturity for low oxygen storage of Simcoe McIntosh lasted only four days. This preliminary result indicates the importance of precise maturity index methods to satisfactory storage management of apples.

Weed Control in Vegetables

Promising herbicide treatments that provide broad spectrum full season weed control with no crop injury include: linuron and metribuzin in seeded asparagus, chlorthal dimethyl plus alachlor (pre-emergence) in cole crops, ethalfluralin (pre-emergence) in cucumbers, and trifluralin or ethalfluralin plus metribuzin (pre-plant incorporated) in transplanted tomatoes. Several new post-emergence grass herbicides look extremely promising for dealing with annual and perennial grass problems.

DOWCO 290 and napropamide gave excellent control of Galinsoga in cabbage. Amino triazole gave satisfactory control of horsetail in asparagus.

Strawberry Program

An extensive research project designed to strengthen Ontario's strawberry processing industry, has been initiated. This cooperative project involves growers, processors, Agriculture Canada, and the Ontario Ministry of Agriculture and Food. It is visualized as a complete program to develop and interrelate new cultivars and cultural techniques with mechanical harvesting and associated processing technology. Test marketing will also be an important aspect.



Figure 11. This newly developed mechanical strawberry harvester will play a key role in an extensive strawberry research program.

Pickling Cucumbers

Evaluations for female flowering, fruit quality, yield, processing quality, and suitability for hand or machine harvesting were conducted on a large number of cultivars. Curbiset, a fruit setting hormone, gave high yields of small cucumbers on some cultivars. A commercial cucumber harvester was modified by fitting it with small diameter rolls. This resulted in a significant increase in the recovery of the valuable small cucumbers, especially of grade 1B (1.9 — 2.5 cm in diameter).

Sulphur coated urea (32-0-0) was evaluated as a source of nitrogen, but it did not appear to have any advantage over conventional N sources for cucumbers.

Pre-treating Peppers

A two year study showed that soil fumigation under the conditions of these experiments (low nematode populations in the soil) did not result in increased yields of peppers. Pre-treatment of pepper seed by soaking in a 0.5% solution of KNO_3 + K_2PO_4 for five days prior to sowing gave a five- to seven-day advantage in germination and emergence over untreated seed. This is very desirable in the production of greenhouse-raised

transplants. A four year study showed very little difference in early or total yield between peppers raised in peat pots, "Speedlings" or greenhouse flats.

Controlling Cabbage Thrips

Results from a study of the biology and control of cabbage thrips indicate the most effective control compounds are dimethoate (Cygon) and parathion, provided that spray programs begin before head formation and continue on a 10 day schedule.

Greenhouse Tomato Breeding

Good progress has been made in the development of hybrids that set freely at low night temperatures with a minimum shaking of the flowers and with resistance to a wide spectrum of diseases. Increased emphasis has been placed on the development of pink fruited inbreds with greater firmness, fruit size and crack resistance. These lines are now producing fruit of acceptable commercial size and quality, and are being stabilized in preparation for their use in commercial hybrids.

Field Tomato Breeding

WONDERVEE (Ont 773) has been named. It has shown promise in experiment station, processor, and grower trials as a smooth deep-fruited, early midseason, hand pick line suitable for fresh market, juice and product. It is not jointless or crimson fleshed but has good firmness, structure, color, flavor and crack resistance. Fruit size is medium to large (153 g). Wondervee is resistant to verticillium wilt and has intermediate resistance to the herbicide metribuzin. Commercial production of about 100 acres is planned for 1982.

VEEKING (tested as C43CAAA, 7915 and Ont 8112) is a late, round machine harvest cultivar suitable for juice, whole pack and product. It is large enough (122 g) for hand picking. It is jointless and crimson fleshed with excellent flavor. Veeking is resistant to verticillium and fusarium wilts and has good resistance to metribuzin. Commercial production of about 100 acres is planned for 1982.

Several machine-harvest and hand-pick breeding lines have shown promise for product, juice, whole pack or fresh market, and are in processors' and growers' advanced trials. These include the first cultivars developed in Ontario with resistance to bacterial speck.

Sweet Corn Hybrids

Several inbreds released by the station are being used in commercial cultivars. Early Sunray and Seneca Horizon each contain one HES inbred and Rekavee contains two.

A number of experimental hybrids ranging from very early to late maturity are now in advanced grower tests. The most promising of these will be named.

Seed Potatoes

Research was initiated in 1981 to use tissue culture as a method of rapid multiplication of virus indexed potato plants. New Canadian cultivars from Guelph and Fredericton were highlighted. Plants have been successfully cultured and transferred to a greenhouse environment, and multiplication rates have been high.

Cultured plantlets become ready for further cuttings three to four weeks after placement of cuttings in test tubes. An average of five cuttings per month has been obtained. Tissue culture has allowed the production of

large numbers of virus indexed plants to supply the Elite seed program. This enables the entry of new Canadian cultivars onto the market much more quickly than in the past.

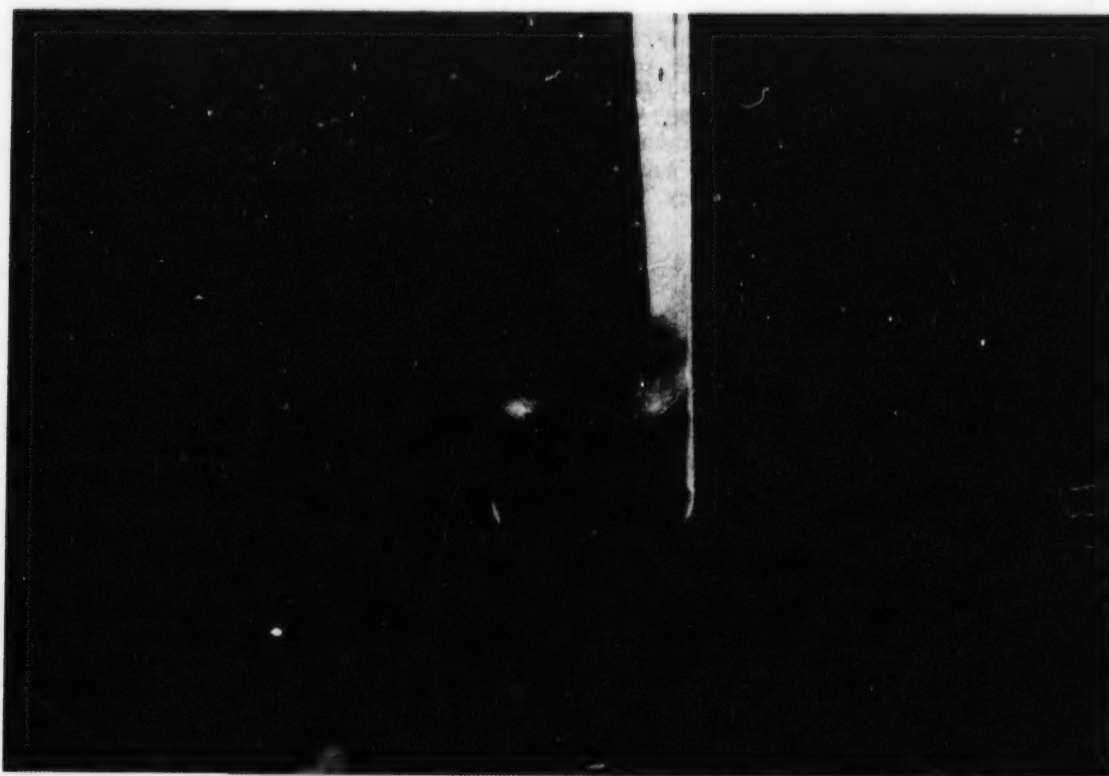


Figure 12. Shown above is a newly-made nodal cutting of potato on agar in a test tube.

MUCK RESEARCH STATION — HOLLAND MARSH

In recent greenhouse cucumber trials, it was found that air temperatures could be lowered by 5°C with no decrease in yields, provided the cucumbers are planted on hills and covered with black plastic. The trials are aimed at energy conservation.

Cavity spot in carrots is an ongoing problem, although some progress has been made by reducing fertilizer rates. Low levels of major nutrients in the soil appear to reduce the amount of lesions on the roots. Working the fertilizer to a 20 cm depth in the soil also helps reduce cavity spot. The disease is not affected by nitrogen sources, although low levels of nitrogen produce better stands.

Increased emphasis was placed on the long term storage of celery. Treating pre-cooled celery with either chlorine or benomyl helped keep the stalks green with no significant deterioration, over an eight week period. Beyond this time period, the petioles outside the heart developed a dark colored decay which has not yet been

identified. Other storage trials were conducted on onions and carrots.

A sodium formation of maleic hydrazide proved to be as effective as the amine form in preventing sprouting of onions in storage. Late afternoon, when the leaves are dry, was found to be the best time to apply maleic hydrazide on onions.

Cooperative trials on disease and insect control in carrots and onions continue to be conducted with the Department of Environmental Biology of the University of Guelph. An extensive pest management program carried out by University personnel is increasingly popular with local growers. The program's results help farmers to use pesticides with maximum effectiveness and minimal input.

Cultivar evaluations on onions, carrots (packaging and processing types), lettuce, celery, potatoes, spinach, cauliflower, brussel sprouts and greenhouse cucumbers were conducted.

KEMPTVILLE COLLEGE OF AGRICULTURAL TECHNOLOGY

ANIMAL PRODUCTION

Fancy White Veal More Profitable

Skim milk, which is low in energy and will not turn out a well finished animal, is frequently used by cream producers to raise fancy white veal. It is now generally known that extracted milk fat can be replaced by emulsified fat, a supplement (unlike milk replacer) that can be adjusted to meet the specific requirements of the calf. Calves on emulsified fat were found to have average daily gains 115.8% higher than calves fed exclusively on a skim milk diet. Feed efficiency was improved 17.7%. The economies of the system are favorable and the market potential excellent.

Lactating Cows on Complete Rations Monitored

The College formulated two complete dairy rations, which in turn were fed to cows on an individual basis. One complete ration was fed to cows producing up to 25 kg of milk/day and the other to cows above that level. The grain to roughage ratios were 35 to 65 and 47 to 53, with a higher level of protein (above 16%) going to the high producers. The high protein level is particularly important in the early part of their lactation.

Results show that feed intake varies from under 3% on a dry matter basis to over 5% for individual cows. Although milk production can be affected by the quality of constituents in a ration (particularly the roughage), both intake and palatability appear to be important factors.

FIELD CROPS

Corn: Plant Density, Fertilizer Application, Hybrid Testing

The optimum plant density for corn hybrids appears to be in the range of 51,000 plants per hectare. At this level, grain yield is 8% higher than plots with a density of 44,460, the lowest density in the trials. Densities ranging from 59,000 to 74,000 also yielded less. The percentage of broken stock increased significantly from 23 to 54 as plant density increased. Three hybrids were used in the trials.

Urea fertilizer was found to be more effective when applied in spring rather than in fall. Corn yields on sandy soil were 18% higher; on clay soils, 5% higher. This confirms the results of previous research. Current research has, however, disproved the notion that corn hybrids react differently to nitrogen.

Close to 200 corn hybrids were tested at four locations throughout eastern Ontario. The soil types ranged from light loam to heavy clay, and the number of corn heat units from 2,300 to 2,750.



Figure 13. Technician weighs fat supplement for veal project.

Forages: Potassium, Direct Seeding, Cultivar Trials and Herbicide Testing

It is now known that the addition of potassium in excess of soil test levels will not produce higher yields. Alfalfa showed no response to additional potassium applied at rates up to 240 kg/ha. All plots yielded between 10 and 12 t/ha.

Direct seeding proved to be a better way to establish an alfalfa stand than planting with a companion barley crop. In the year following seeding, alfalfa that had been seeded directly yielded 7% more. In contrast, direct-seeded red clover yielded approximately the same as red clover seeded with barley.

Cultivar trials continued to show small but consistent gains in alfalfa, red clover, trefoil, white clover, alsike, and grasses (brome, orchard, timothy and red canary). New red clover cultivars demonstrated superior persistence. Prosper 1, Florex, and Arlington yielded in excess of 10% more than check cultivars.

Recent trials indicate that MCPA is not as effective a herbicide as 2,4D when alfalfa is treated with equal amounts of each. MCPA, when applied at the third or fourth trifoliate stage, reduces yields more than 2,4D. The herbicide EPTC appears to perform better when sprayed. Pre-treated seeds are between 75 and 95% as effective as conventional spraying. Some damage was, however, observed in seedlings.

New Herbicides Help Soybeans

The application of several new experimental herbicides at the one to two leaf stage of growth of soybeans has resulted in 75 to 100% control of annual grasses and quack-grass. Experiments of this nature continue to support the expansion of soybean acreage in eastern Ontario.

Cereal Cultivar Testing

Close to 100 cultivars of two-row and six-row barley, and oats, have been tested for yields, lodging, and disease.

HORTICULTURAL CROPS

Heavy Damage to Apple Trees

The severest winter since 1933 killed 19% of Eastern Ontario's apple trees. The Malling 106 rootstock was the heaviest hit; 49% were killed. Two rootstocks, the 03 and 08, were relatively undamaged.

Lowbush Blueberries Perform Well

Lowbush blueberries have performed well in field trials. Although last year the bushes gave a small yield, some of the plants have spread to a diameter of 25 cm. Commercial growers are expected to plant 20 acres in 1982.

Early Maturing Broccoli

The earliest varieties, harvested between 29 August and 1 September, yielded 4 tonnes more marketable produce than the varieties harvested between 8 and 10 September. Later crops were severely affected by head rot, the results of bad weather. Premium Crop and Green Charger had superior yields at 14.6, 16.8 t/ha respectively. They too were affected by head rot. Green Hornet, which had a peak harvest date of 31 August, had a superior quality yield of 13.8 t/ha.

Cauliflower Varieties

Of the 10 earlier varieties of cauliflower tested, Snow Crown, which had a harvest date of 6 July, proved superior. It yielded 16.8 t/ha and had tight compact curls. Alpha Paloma, which had a harvest date of 12 July and excellent quality, gave the highest yield, 17.5 t/ha. Other top performers included Meckelse Merita and type 338A, with 14.8 and 16.15 t/ha respectively.

Of the late cultivars, White Contessa matured earliest, but had low yields and poor quality. SG-109, Self Blanche, and White Summer had the largest head sizes (861 grams), good quality, and yields of between 21.1 and 24.5 t/ha.

Cabbage Cultivars

Early maturing Earlianna (26 June) yielded only 13.1 t/ha of poor quality produce. Emerald Acre showed the best yield potential at 14.4 t/ha but quality was average. At 23.2 t/ha, Princess proved to be the superior cultivar. Sun-up was the best of the later cultivars. It yielded 83.9 t/ha and stayed in the field without splitting.

Sweet Corn Hybrids

At 1521 CHU, Ontario hybrid 797 matured earlier than ten other cultivars. It snapped easily and had good flavor but poor tip cover. Another early variety, Jubilee, had yields of 18.3 t/ha but was difficult to snap. Flavourvee, which was the latest maturing variety, had excellent yield and flavor.

Tomato Cultivars Evaluated

Of the ten cultivars evaluated in four replicate plots, Earlibright, Earlirouge and Basketvee were the superior varieties. TH-318 (Heinz) had good fruit size (146 g) and showed promise as an early variety. Earlibright and Earlirouge produced good yields, and had good size and color (126 and 32 g respectively).

Maple Syrup Purified

A water purification unit containing an ultra violet light was used to sterilize maple syrup. Only 2% of the bacteria survived the purification and the syrup produced was of extremely high quality.

ENGINEERING

A tractor performance meter has been designed which allows the operator to maximize tractor performance while conserving fuel.

In order to measure how much heat can be generated under eastern Ontario conditions, a free standing solar collection panel has been constructed.

HOME ECONOMICS

The tough, chewy texture of hull-less oats has been overcome through a new method of low temperature cooking.

Veal calves fed skim milk supplemented with various levels of emulsified fat from beef animals, showed significant increases in the amount of inter-tissue fat. Further tests should reveal how much the marbling — believed to give beef its rich flavor and juiciness — has increased.

NEW LISKEARD COLLEGE OF AGRICULTURAL TECHNOLOGY

ANIMAL PRODUCTION

Heavy Calves

Intact Holstein male calves were raised to a weight of 230 kg on whole grain barley and protein supplement to examine the possibility of increasing dairy farm income through raising heavy veal. The calves had an average daily gain of 1.1 kg and an average feed conversion of 3.25 kg feed/kg gain. Average days to market weight was about 150.

Beef Cattle

Cross bred steers are being utilized in a trial to compare their performances under cold and warm housing conditions. All rations consist of 70% silage to 30% gain on a dry matter basis. Initial results indicate a significantly higher average daily gain of those housed indoors during periods of extremely low temperatures. There is also evidence that compensatory growth occurs in the steers housed under cold conditions as the ambient temperatures approach 0°C.

In a subsidiary trial, the performance of cross bred steers (housed outdoors) fed standard wilted alfalfa silage are being compared with others fed formic acid treated high moisture alfalfa silage. To date, there has been no significant difference in daily weight gain between the two groups.

Sheep Feed Trials

Preliminary results indicate that ewes perform equally well with both high moisture formic acid alfalfa and conventional wilted alfalfa silage.

FIELD CROPS

Cereals Comparison

Various varieties and plant breeder lines of barley and oats were evaluated for yield, lodging, and disease resistance. In two separate trials, several Scandinavian oat cultivars outperformed oat varieties currently recommended for Ontario. In similar comparisons for barley, recommended varieties performed as well or better than Scandinavian varieties.

Most of the 20 cultivars and plant breeder lines of Winter Triticale were sufficiently hardy to survive New Liskeard conditions. Yield and lodging resistance were good, although grain thrashability was poor and most lines showed some ergot infection.

Various nitrogen fertilization trials were carried out with barley to examine differences due to formulation, timing, and method of applying fertilizer. A comparison of urea and ammonium nitrate sources revealed no differences in yield when equivalent amounts of elemental nitrogen were applied. Early application of nitrogen at seeding time resulted in yields equal or superior to split applications and top dressing

at various stages up to heading. Three early nitrogen application systems — broadcast on seed bed, broadcasting and working in, and banding with seed — indicate no yield differences with either urea or ammonium nitrate.

Early Corn Hybrids

Seventeen recommended early corn hybrids were compared for their silage yield characteristics at New Liskeard and at off-station tests in Algoma and Nipissing. Yields of dry matter in tonnes per hectare averaged 10.5 at Nipissing, 11.7 in Algoma, and 13.7 in New Liskeard.



Figure 14. Winter triticale plots at New Liskeard are shown above.

Canola Cultivars

Six varieties of Argentine type and four varieties of Polish type canola were compared for yield, straw strength, and oil content. Yields of the Argentine varieties varied from 2010 to 2320 kg/ha, and the Polish type from 940 to 1250 kg/ha.

Forages

Different varieties and plant breeder lines of alfalfa, trefoil, red clover, brome grass, reed canary grass, and rye grass were evaluated for yields under hay management conditions. Excellent growing conditions resulted in excellent yields for most cultivars, including three cuts of the alfalfa tests.

The effect of fall cutting management of alfalfa was studied for the fourth year. Significant yield depressions were apparent for alfalfa cut between the critical dates of 10 August and 20 September.

The effect of timing and rate of nitrogen fertilization of brome grass were studied. Maximum yields resulted from split applications: half early in spring and half immediately after first harvest. Rates of application from 113 kg/ha up to 224 kg/ha increased dry matter yield. However, rates in excess of 224 kg/ha appeared to depress yield.

HORTICULTURAL CROPS

Cole Crops

A study to determine the production requirements of summer cole crops involved three cultivars of broccoli, two cultivars of cabbage, and three cultivars of cauliflower. Each cultivar was transplanted at two different dates and direct seeded at one date. In all cases, direct seeding produced high quality heads but lower marketable yields.

SOILS

Tillage Trials

The first year of a trial to compare various combinations of primary (moldboard plow vs chisel plow) and secondary (disc and harrow vs cultivator) tillage on barley yields has been completed. Preliminary results indicate that tine only cultivation (chisel plow cultivators) produces lower yields and more weed problems.

PROVINCIAL PESTICIDE RESIDUE TESTING LABORATORY

Aminopyridine and Bird Control

Aminopyridine (Avitrol) is intended to frighten birds and thus protect ripening crops, food establishments, and buildings from deterioration and spoiling. The injected compounds cause birds to become disoriented and to emit distress calls, which in turn scatter the flock. A small percentage of birds injected fatal doses. House sparrows, redwing blackbirds, and pigeons died within minutes of feeding. A few survived, incapacitated for up to 90 minutes, and some herring gulls were found dead up to 5 km away. The lethal dose for all species appeared to be around 4 mg/kg. The bait contained up to 26 mg/kg.

Permethrin and the Control of Fowl Mite

Laying hens were treated with permethrin at a rate of 20 mg/bird to determine efficacy against northern fowl mites and the dissipation of residues over a 42 day period. Permethrin provided greater than 99% control of mites for at least 42 days post-treatment as compared to malathion which did not substantially reduce mite infestations. Carbaryl and coumaphos treatment resulted in only limited and transitory reductions of mite infestation.

Maximum residues of permethrin in breast muscle, body fat, and the uropodium occurred on the first day of post-treatment and were still present in fatty tissues on day 42. Residues in egg yolk appeared on day 3 post-treatment and peaked on day 7 with trace quantities still present on day 21. Permethrin was not found in egg white, although low residues were found in the liver and gizzard from day 1 through 7.



Figure 15. Technician distills off Daminozole from maserated apple tissues in preparation for measuring levels.

Metalaxyl and Blue Mold Control

Two or three foliar sprays of 0.12 kg/ha of metalaxyl effectively controlled tobacco blue mold. After flue-curing, metalaxyl levels were low (<1 ppm). However, when leaf samples were flue-cured among leaves of a metalaxyl-treated crop, residue levels were found, even in leaves that had never received metalaxyl sprays. This indicates that metalaxyl is sufficiently volatile under kiln conditions to be redistributed among leaves.

Relationship of Vapor Pressures to Initial Pesticide Residues

Field tests, in which several insecticides were applied at equal rates by ground sprayer to oats, rye, and alfalfa, showed that residues one hour after application are much lower for highly volatile compounds than for those of lower volatility. Variations in distance of 10 to 40 cm from spray release to target canopy did not significantly affect the deposit. Results indicate that applying insecticides with a vapor pressure greater than approximately 10^{-4} mmHg (20°C) in aqueous media is inefficient.

Diphenamid Residue in Tobacco

Flue cured tobacco crops were treated at the prescribed rate of 6.75 kg of diphenamid (active ingredient) per hectare on a 25 cm band. Residues ranged from 9 mg/kg in the sand leaves to 0.2 mg/kg in the tip leaves.

Atrazine and Crop Injury

The response of five crop species to levels of atrazine of between 0.05 and 0.70 mg/kg were studied in three soils with increasing organic matter contents: sand, clay loam, and organic-clay loam. The severity of injury symptoms was similar in all five plant species on soils of low organic matter. Alfalfa, which was affected by levels of atrazine as low as 0.05 and 0.10 mg/kg on the two soils of low organic matter, appeared to be the most sensitive of the five crops. Barley, oats, soybeans, and tomatoes, which showed initial injury in soils with 0.10 to 0.30 mg/kg atrazine, were slightly more tolerant.

Residues in Treated Wild Berries

Between 1979 and 1981 wild red raspberry, blueberries, wild strawberry and pin cherry from 24 sites across northeastern Ontario were analysed for chlorophenoxy herbicide residues. Application rates to right-of-ways or forested areas varied from 0.8 to 6.0 kg/ha total acid equivalent. When both mature or immature berries were sprayed, residues were found in ripe fruit. However, spraying while in flower resulted in negligible residues.

Human Exposure to Spraying with Herbicides

Occupational exposure to chlorophenoxy herbicides were measured among 24 applicators who treat right-of-ways. Dermal absorption proved to be 50 times greater than the inhalation route when using a hand gun. Even with the mist blower, dermal absorption was 4 to 11 times greater than the breath inhalation route. Worker education and improved protective equipment significantly reduced urine concentrations of herbicide residues.

RIDGETOWN COLLEGE OF AGRICULTURAL TECHNOLOGY

ANIMAL PRODUCTION

Beef Cattle

In a study of the reproductive efficiency of beef heifers, increased protein and energy levels were shown to improve growth in both bred heifers and suckling calves. However, birth weight, calving ease, and conception rates were unaffected by the higher levels.

In an ongoing trial comparing early (70 day) and normal (180 day) weaning times for beef calves, the early weaned calves at 180 days of age showed a 14 kg improvement in weight gain. In a related study, Ralgro implants administered at birth and at 90 days of age resulted in an improved weight gain of 6 kg at 180 days of age.

The supplementation of diets with Aureo S-700 and potassium for newly arrived western Canadian cattle was studied. Aureo S-700 improved animal performance and reduced incidences of illness during the 56 day trial, whereas supplements containing K did not.

Dairy Cattle

For a second year, Beta-Carotene was added to the corn silage rations of high producing dairy cattle in order to assess the effects on reproductive performance. Contrary to preliminary findings, reproductive performance was not altered when these cows were compared to cows consuming adequate levels of Vitamin A in their diets.

Swine

The feeding of home grown feeds to market pigs for maximum economic benefit is a major goal of swine research at Ridgetown. In a controlled feeding study of both grower and/or finishing pigs, restricted feeding as opposed to traditional feeders and floor feeding has been found to be more profitable.

Halothane gas testing has been used as a routine selection tool to reduce the incidences of Porcine Stress Syndrome (PSS) and Pale Soft Exudative pork (PSE).

The advantages of medicated feeds for growing/finishing pigs have been difficult to establish. The evaluation of the economic and production benefits of high protein synthetic lysine, growth promotants, and medications in starter feeds, continues.

In an effort to minimize energy costs, automatically controlled air inlets are being tested, as are on-farm constructed heat exchangers and solar heating in swine barns.

FIELD CROPS

Corn

Corn performance data compiled in early December has resulted in the deletion of 74 corn hybrids and the



Figure 16. Ear tagging of research cattle plays important role in feeding trials.

addition of 22 new hybrids to the recommended list. This should result in an increase of approximately 50,800 tonnes per year. Optimum standability and yields were obtained with populations of 52,000 plants per hectare. Preliminary studies indicate that previous crops of alfalfa or trefoil supplied 100 kg of nitrogen per hectare to the corn crop.

Research continues in the study of nitrification inhibitors and anhydrous ammonia in corn. An insignificant increase from the use of N-Serve with preplant nitrogen was observed at two sites.

Other projects to date include: potassium and phosphate maintenance trials on a residual basis; a study of the use of farmyard manure on corn crops; research involving composted sewage sludge on sandy and clay loam soils; and windbreak studies on sandy loam soils. Preliminary results from the treatment of acid clay loam soil with calcitic and dolomitic limestone indicates minimal yield increases for the use of limestone.

Forages

Ridgetown data was instrumental in supporting the licensing of seven new perennial forages: three alfalfa, two white clover, one red canary grass, and one trefoil. An extensive study of seed coatings for alfalfa and trefoil indicates no advantages in plant stands or yields. The application of Lexone in late fall to dormant alfalfa has, however, resulted in excellent control of dandelions and shepherd's bush the following spring.

Cereals

Ridgetown data was instrumental in supporting the licensing of one winter barley, two oat, one 2-row spring barley (Birka), and one 6-row barley (Leger).

Ethepon, a material recommended for use in orchards to promote fruit color and ripening, shows great promise as an antilodging chemical in barley. Reduced harvest costs and increased yields are two potential benefits.

Commercial seedlots of winter wheat have been divided into heavy, medium and light weight seed lots through the use of a commercial electrostatic seed size separator. A three year study into the use of heavy seeds indicates that they do not increase yields. Extensive research into the use of nitrogen on winter wheat has, however, confirmed that optimum yields are obtained with 90 kg of nitrogen per hectare.

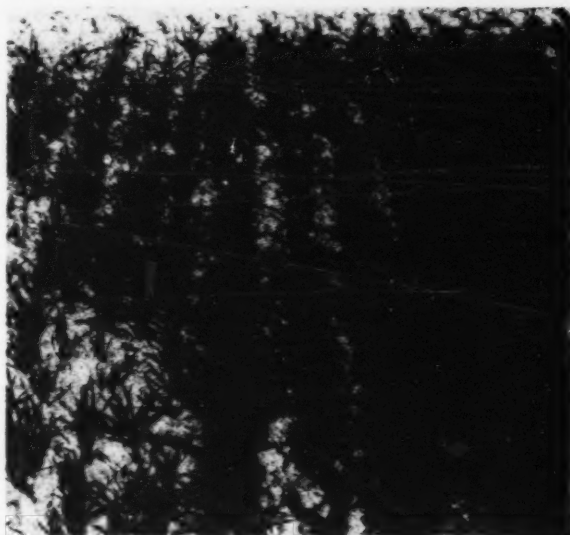


Figure 17. The effects of row spacing on yield of spring barley is being evaluated.

Beans

Soil test calibration studies with soybeans were conducted for the second year. Studies with white beans were initiated. Soil tests for potassium and phosphorous proved to be accurate predictors of the amounts required for optimum yields.

The data from five soybean variety trials were used to support nine new varieties for licensing and 140 advanced breeding lines for evaluation.

Previous findings concerning narrow row widths were confirmed: a 3 to 28% yield increase was demonstrated across locations, although there was a suggested differential varietal response.

White bean and colored bean management studies were initiated; white bean varieties were evaluated at three locations. Screening for root rot tolerance, ozone

tolerance, and upright plant morphology met with modest success. Agronomic studies were also conducted with colored beans, peanuts, and winter rapeseed.

Weed control in beans continues to be a major research activity. Several postemergence grass herbicides, when applied at the two to three leaf stage, were found to be an effective control against annual grasses, although some chemicals caused slight injuries. Herbicides applied to kidney and white beans gave excellent control of broadleaf weed and grasses without crop injury.

HORTICULTURAL CROPS

Preferred Tomato Cultivars

All Ontario tomato breeding lines were grown and evaluated under southwestern Ontario conditions. Of 800 different F₂ lines, 172 selections were subjected to extensive testing and will undergo further testing. Veeking (ONT 8112) was introduced to Ontario growers. The testing of advanced cultivars under the newest management and cultural methods has resulted in excellent cultivars for Ontario. Extensive grower trials with a modified gel seeder gave encouraging results, and may lead to increased hectares of field seeded tomatoes.

Other projects to date include breeding and selection work in peppers, and weed control research in horticultural crops. All projects indicate excellent potential.

PEST MANAGEMENT AND DISEASE CONTROL

Insecticides and fungicides were tested to evaluate the control of insects and diseases on crops such as cabbage, cucumbers, peas, tomatoes, barley, field corn, and rye. Research included the use of synthetic pyrethroid-type insecticides to control cabbage worm and European corn borer. Multiple applications gave the best control, although single applications of some insecticides were moderately effective.

Bacterial speck and anthracnose in tomatoes continue to be major problems, although copper-mancozeb and plant resistance sprays are used to combat bacterial speck. Fifty-five breeding lines were screened for resistance. Preliminary results indicate a measure of differential response. A question has arisen, however, as to the role foliar nutrition plays in plant susceptibility to lesions.

A new plant applicator for applying corn rootworm insecticides and a micro-max rotary nozzle spraying system were tested and found efficient. Different types of agitators — jet, mechanical, and pneumatic — were compared. Mechanical agitation was found to be superior. If jet agitation is used, pneumatic assistance is required.

In white bean research, Ex Rico, a new cultivator, shows promise in resisting white mold.

The predominant aspect of weed control research, which was conducted on 17 crops including 11

horticultural crops, was the use of two and three way mixes of herbicides for broadleaf weed and grass control. Many of the combinations gave excellent results. Due to excessive rainfall, pre-emergence treatments were found to be more effective than preplant incorporated applications.

Specific weeds studied included velvetleaf and quackgrass. Preplant incorporated and pre-emergence applications of metribuzin were efficient at controlling velvetleaf. Quackgrass was controlled with rates of Roundup as low as 0.5 kg active per hectare plus oil. A micro-max controlled drop applicator was used. Studies into the use of wick applicators continued. A number of variations were built and tested using Roundup on weeds growing above soybeans.

It is now known that cultivation in combination with herbicides, gives better weed control than the same treatment without cultivation. The weed control from banded treatments plus cultivation did not differ from broadcast treatments of herbicides.

AGRICULTURAL ECONOMICS

New Newsletter

Interest in on-farm computers is increasing rapidly. Consequently, research is being conducted to evaluate hardware and software available to farmers. A computer information letter, which was initiated in 1981, has grown to a circulation of about 1,000. The letter keeps the farming public and related industry personnel informed of new developments.

